PAPER FEEDER AND IMAGE FORMING APPARATUS HAVING THE SAME

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a paper feeder for storing recording media and an image forming apparatus having the paper feeder, and particularly relates to a paper feeder capable of locking each paper feed cassette to prevent recording media stored in the paper feed cassette from being taken out freely from the paper feed cassette, and an image forming apparatus having the paper feeder.

Background Art

Paper feed cassettes of an image forming apparatus such as a printer are generally filled with sheets of plain paper. Occasionally, however, by use of mica toner containing magnetic powder or the like, numeric characters may be printed on securities such as checks charged into a paper feed cassette. The checks or the like subjected to printing thus can be used immediately for economic transactions. From such convenience, printers have been increasingly used for such applications in recent years.

When a printer is used for such applications, it is necessary to protect the securities in the paper feed cassette from theft. In order to prevent theft, therefore, in the

background art, a locking unit or the like is provided for preventing recording media in a paper feed cassette from being taken out freely when printing is performed on securities (see JP-A-2001-121795, page 3, Fig. 1).

SUMMARY OF THE INVENTION

In the aforementioned document, the case for only one paper feed cassette is taken into consideration, but the case for a plurality of paper feed cassettes is not taken into consideration. When a plurality of paper feed cassettes are provided in the technique disclosed in the aforementioned document, a plurality of locking units must be provided for the paper feed cassettes respectively, and a user must lock the paper feed cassettes individually. Such an operation is troublesome for the user and also disadvantageous in terms of cost. With the number of paper feed cassettes increasing, the technique is more disadvantageous in terms of workability or cost.

A paper feeder capable of locking a plurality of paper feed cassettes in an easy operation, and an image forming apparatus having the paper feeder is disclosed herein.

According to an aspect of the invention, a paper feeder includes: a first paper feed cassette in which to store a recording medium with a lock state that is selected from an unlocked state where the recording medium can be taken out

therefrom and a locked state where the recording medium cannot be taken out therefrom; a locking portion that determines whether to bring the lock state of the first paper feed cassette into the unlocked state or the locked state; a second paper feed cassette in which to store a recording medium, capable of selectively entering an unlocked state where the recording medium can be taken out therefrom and a locked state where the recording medium cannot be taken out therefrom; and a lock state transmitting portion that transmits the lock state of the first paper feed cassette to the second paper feed cassette to bring the second paper feed cassette into the unlocked state or the locked state in accordance with the lock state of the first paper feed cassette.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be more readily described with reference to the accompanying drawings:

Fig. 1 is a front perspective view showing a laser printer according to a first embodiment of the invention, with an explanatory side view of a gang lock unit provided in the laser printer.

Fig. 2 is a schematic perspective view showing a printer body in the laser printer in Fig. 1.

Fig. 3 is a sectional view taken on line III-III in Fig. 2.

Fig. 4 is a front perspective view showing a laser printer according to a second embodiment of the invention, with an explanatory side view of a gang lock unit provided in the laser printer.

Fig. 5A is a schematic perspective view showing a printer fixing bar provided in a support base for supporting the laser printer according to the first embodiment of the invention.

Fig. 5B is a schematic perspective view showing a printer fixing bar provided in a support base for supporting the laser printer according to the second embodiment of the invention.

Fig. 6 is a front perspective view showing a laser printer according to another embodiment of the invention, with an explanatory side view of a gang lock unit provided in the laser printer.

Fig. 7 is a front perspective view showing a laser printer according to another embodiment of the invention, with an explanatory side view of a gang lock unit provided in the laser printer.

Fig. 8 is a front perspective view showing a laser printer according to another embodiment of the invention, with an explanatory side view of a gang lock unit provided in the laser printer.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the invention will be described

below with reference to the drawings.

Fig. 1 is a front perspective view showing a laser printer according to a first embodiment of the invention, with an explanatory side view of a gang lock unit provided in the laser printer. The laser printer 1 is constituted by a printer body 1a and a stack of three paper feed cassette units 1b, 1c and 1d disposed under the printer body 1a. The paper feed cassette units 1b, 1c and 1d are separate from the printer body 1a and have the same configuration as one another. Each paper feed cassette unit 1b, 1c, 1d can be removably attached to the printer body 1a. A user can remove the paper feed cassette unit desirably or install another paper feed cassette unit having the same configuration additionally. More in particular, the printer body 1a and the paper feed cassette units have foot portions in their bottom surface respectively (only foot portions 61 of the lowest paper feed cassette unit 1d are shown in Fig. 1). The printer body 1a and the paper feed cassette units are disposed in a stack without any misalignment due to the foot portions 61 engaging with lower units respectively.

Here, each member is denoted by a reference numeral with a suffix "a", "b", "c" or "d" showing which one of the printer body 1a and the paper feed cassette units 1b, 1c, 1d the member belongs to.

A paper feed cassette 6a storing securities such as checks as recording media is provided in the printer body 1a removably

in a direction perpendicular to the paper of Fig. 1. Similarly in each paper feed cassette unit 1b, 1c, 1d, a paper feed cassette 6b, 6c, 6d is provided removably in a unit body 60b, 60c, 60d. Incidentally, a recess portion 16a, 16b, 16c, 16d for making the user easier to put his/her fingers therein when he or she pulls out each paper feed cassette 6a, 6b, 6c, 6d is formed at the front of the paper feed cassette 6a, 6b, 6c, 6d.

A gang lock unit is provided on the front left side of each paper feed cassette 6a, 6b, 6c, 6d. The gang lock unit performs gang locking as follows. That is, as soon as the paper feed cassette 6a provided in the printer body 1a is brought into a locked state, the gang lock unit automatically brings the paper feed cassettes 6b, 6c and 6d of the paper feed cassette units 1b, 1c and 1d stacked under the printer body 1a, into the locked state.

Incidentally, the locked state means a state where the paper feed cassette 6a, 6b, 6c, 6d is prohibited from being pulled out, so that checks 3 in the paper feed cassette 6a, 6b, 6c, 6d cannot be taken out. An unlocked state means a state where the paper feed cassette 6a, 6b, 6c, 6d is allowed to be pulled out so that the checks 3 can be taken out.

A tag 14 is exposed to the apparatus front on the left side of the paper feed cassette 6a of the printer body 1a (see Fig. 2), while a lock gear 51a, a cylinder 54a fixed to the back side of the lock gear 51a, and so on, are stored in the

apparatus. That is, all the members of the gang lock unit but the tag 14 provided on the left side of the paper feed cassette 6a of the printer body 1a are stored in each unit but invisibly from the front surface. However, in order to make the description easier, those members are shown by the solid lines in the front view on the right side of Fig. 1, and shown schematically in the explanatory view on the left side of Fig. 1.

A key hole 14a to which a key 90 can be inserted is formed in the tag 14. The key hole 14a is formed continuously in the lock gear 51a and the cylinder 54a in the printer body 1a which will be described later. That is, the front end of the key 90 is designed to penetrate the tag 14 and the lock gear 51a and reach the inside of the cylinder 54a.

Lock gears 51a, 51b, 51c and 51d are provided correspondingly to the paper feed cassette 6a of the printer body 1a and the paper feed cassettes 6b, 6c and 6d of the paper feed cassette units 1b, 1c and 1d respectively. Each lock gear 51a, 51b, 51c, 51d is a circular plate-like member having a gearing groove formed in its circumferential edge. A columnar cylinder 54a, 54b, 54c, 54d is fixed to the back side of the lock gear 51a, 51b, 51c, 51d.

A hook 53a, 53b, 53c, 53d and a locking bar 52a, 52b, 52c, 52d are fixed to the circumferential surface of the cylinder 54a, 54b, 54c, 54d in turn in order of increasing distance from

the tag 14. Accordingly, the cylinder 54a, 54b, 54c, 54d rotates with the rotation of the lock gear 51a, 51b, 51c, 51d in the locking operation, so that the hook 53a, 53b, 53c, 53d and the locking bar 52a, 52b, 52c, 52d fixed to the cylinder 54a, 54b, 54c, 54d also rotate together.

Each locking bar 52a, 52b, 52c, 52d is a bar-like member which is received in a recess portion 55a, 55b, 55c, 55d provided in the locking-portion-side side surface of the paper feed cassette 6a, 6b, 6c, 6d in the locked state. In Fig. 1, the locking bars 52a, 52b, 52c and 52d in the locked state are shown by the solid lines and in the unlocked state are shown by the broken lines.

A grappling portion is formed at the tip of each hook 53a, 53b, 53c, 53d. The hooks 53a, 53b and 53c except for the lowest hook 53d engage with hook destinations 80b, 80c and 80d provided to project on the top of the unit bodies 60b, 60c and 60d in the paper feed cassette units 1b, 1c and 1d, respectively. Each hook destination 80b, 80c, 80d is a bar extending perpendicularly to the paper of Fig. 1. The hook destination 80b, 80c, 80d is attached to be put between two vertical members (not shown) attached to the top of the paper feed cassette unit 1b, 1c, 1d. Thus, the hook destination 80b, 80c, 80d is disposed to project on the top of the unit body 60b, 60c, 60d.

On the other hand, the hook 53d provided for the paper feed cassette 6d closest to a support base 200 supporting the

apparatus engages with a printer fixing bar 201 provided in the support base 200. The printer fixing bar 201 is a U-shaped member, which is attached to project from the surface of the support table 200 as shown in Fig. 5A. The support base 200 provided with the printer fixing bar 201 thus is sold, particularly as a support of the laser printer 1 according to this embodiment, in set with the laser printer 1.

Incidentally, in the same manner as the locking bars 52a, 52b, 52c and 52d, in Fig. 1, the hooks 53a, 53b, 53c and 53d in the hooked state are also shown by the solid lines and in the unhooked state are also shown by the broken lines.

The lock gears 51a and 51b are connected to each other through three transmission gears 70a, 71b and 72b disposed between the lock gears 51a and 51b. The lock gears 51b and 51c are connected to each other through three transmission gears 70b, 71c and 72c disposed between the lock gears 51b and 51c. The lock gears 51c and 51d are connected to each other through three transmission gears 70c, 71d and 72d disposed between the lock gears 51c and 51d.

Accordingly, when the key 90 is inserted into the key hole 14a of the tag 14 provided in the printer body 1a and the key 90 is rotated in the illustrated arrow direction (clockwise), the lock gear 51a rotate in the arrow direction together with the tag 14. This rotation is transmitted to the lock gears 51b, 51c and 51d in the lower paper feed cassettes 6b, 6c and

6d through the transmission gears 70a, 71b, 72b, 70b, 71c, 72c, 70c, 71d and 72d. In such a manner, all the gears rotate in the arrow direction in Fig. 1 substantially concurrently.

Incidentally, in this embodiment, the printer body 1a has one lock gear and one transmission gear, and each paper feed cassette unit 1b, 1c, 1d has one lock gear and three transmission gears. The lowest transmission gear 70d provided in the paper feed cassette unit 1d disposed undermost does not serve to transmit the gear rotation. For example, when another paper feed cassette unit is further stacked under the paper feed cassette unit 1d, the transmission gear 70d will serve as a transmission gear.

With the rotations of the plurality of gears, the locking bars 52a, 52b, 52c and 52d and the hooks 53a, 53b, 53c and 53d fixed to the cylinders 54a, 54b, 54c and 54d respectively also rotate in the arrow direction in Fig. 1, respectively. As soon as the key 90 rotates to reach the position of the locked state, the locking bars 52a, 52b, 52c and 52d are received in the recess portions 55a, 55b, 55c and 55d of the paper feed cassettes 6a, 6b, 6c and 6d, while the hooks 53a, 53b, 53c and 53d move in the unit stack direction, that is, downward so as to engage with the hook destinations 80b, 80c and 80d and the printer fixing bar 201 fixed onto the support base 200, respectively.

Incidentally, the locking bars 52a, 52b, 52c and 52d are removable. For example, therefore, when only the locking bar

52b is removed, only the paper feed cassette 6b in the paper feed cassette unit 1b will avoid gang locking and keep its unlocked state even if the other three paper feed cassettes 6a, 6c and 6d are brought into the locked state.

The locking gears 51a, 51b, 51c and 51d, the locking bars 52a, 52b, 52c and 52d, the hooks 53a, 53b, 53c and 53d and the transmission gears 70a, 71b, 72b, 70b, 71c, 72c, 70c, 71d, 72d and 70d constituting the gang lock units are stored in the printer body 1a and the paper feed cassette units 1b, 1c and 1d respectively, and prevented from projecting outside the apparatus even when the paper feed cassettes 6a, 6b, 6c and 6d are in the locked state.

Next, the printer body 1a of the laser printer 1 will be described in detail with reference to Figs. 1 to 3. Fig. 2 is a schematic perspective view showing the printer body 1a in the laser printer 1 in Fig. 1. Fig. 3 is a sectional view taken on line III-III in Fig. 2.

As shown in Figs. 1 and 2, a manual paper feed tray 13 is installed openably and closably above the paper feed cassette 6a of the printer body 1a. An operating portion 15 is provided in a surface formed further above the manual paper feed tray 13 and obliquely from the side surface of the printer to the top thereof as shown in Fig. 2. The operating portion 15 is provided with a liquid crystal display 15a and a plurality of buttons 15b. Settings in the laser printer 1 are shown in the

liquid crystal display 15a. When the user pushes the buttons 15b, the user can do various settings on the laser printers 1.

The check 3 fed from the paper feed cassette 6a or the manual paper feed tray 13 in the printer body 1a is subjected to print processing through the process in which the check 3 is carried along a feed path inside the printer body 1a as will be described later. Then, the check 3 is delivered onto a paper outlet tray 36 by the rotations of a paper delivery roller pair 35 shown in Figs. 2 and 3.

Here, the internal configuration of the printer body 1a will be described with reference to Fig. 3. First, a pressure plate 8, a paper feed roller 9 and a separation pad unit 10 are provided inside the paper feed cassette 6a mounted in the lower portion of the printer body 1a. The paper feed roller 9 is provided above a one-end-side end portion of the paper feed cassette 6a. The paper feed roller 9 rotates intermittently.

The pressure plate 8 has a top on which the checks 3 can be laid, and a bottom urged upward by a spring 8a. In addition, the pressure plate 8 is supported swingably at one end more distant from the paper feed roller 9. Thus, the other end of the pressure plate 8 closer to the paper feed roller 9 is made movable in the up/down direction. The paper feed roller 9 and the separation pad unit 10 are disposed to face each other.

A separation pad (not shown) made from a member having a high friction drag is pressed toward the paper feed roller 9 by a spring 10b disposed on the back side of a pad backing 10c in the separation pad unit 10.

The check 3 fed from the paper feed cassette 6a is fed to a feed roller pair 11 and a resist roller pair 12 through the paper feed roller 9 and the separation pad unit 10 along a feed path 7 shown by the chain line in Fig. 3. The check 3 is corrected for skewing in the position of the resist roller pair 12. The check 3 corrected for skewing is then sent to an image forming position P of the process unit 18 (a contact portion between a photoconductor drum 23 and a transfer roller 25 which will be described later, that is, a transfer position where a toner image on the photoconductor drum 23 is transferred to the check 3), and subjected to printing therein.

The process unit 18 is constituted by a drum cartridge, a developing cartridge 24, and so on. The drum cartridge includes the photoconductor drum 23, a Scorotron type charger 37 serving as a charging unit, the transfer roller 25 serving as a transfer unit, and so on. The developing cartridge 24 can be removably attached to the drum cartridge. The developing cartridge 24 has a toner storage portion 26, a developing roller 27 serving as a developing unit, a layer thickness limiting blade (not shown), a toner feed roller 29, etc. Incidentally, the toner storage portion 26 is filled with mica toner containing

magnetic powder and suitable for the check 3 used as a recording medium as in this embodiment. A toner image carried on the surface of the photoconductor drum 23 is transferred to the check 3 when the check 3 passes between the photoconductor drum 23 and the transfer roller 25.

In addition, a scanner unit 17 is disposed on the lower surface side of the paper outlet tray 36. The scanner unit 17 has a laser beam emitting portion (not shown), a polygon mirror 20 to be driven to rotate, lenses 21a and 21b, a reflecting mirrors 22, etc. Then, a laser beam emitted from the laser beam emitting portion in accordance with given image data is passed through or reflected on the polygon mirror 20, the lens 21a, the reflecting mirrors 22 and the lens 21b in that order. Thus, the surface of the photoconductor drum 23 serving as a photoconductor in the process unit 18 is scanned and irradiated with the laser beam at a high speed.

A fixing unit 19 serving as fixing means to thermally fix the image on the check 3 is disposed on the downstream side of the process unit 18 along the feed path 7. The fixing unit 19 has a heating roller 30, a pressure roller 31 disposed to press the heating roller 30, and a feed roller pair 32 provided on the downstream side of the rollers 30 and 31. The heating roller 30 is made from metal such as aluminum, and provided with a heater such as a halogen lamp for heating so that the toner transferred onto the check 3 in the process unit 18 is

fixed thermally when the check 3 passes between the heating roller 30 and the pressure roller 31. After that, the check 3 is carried to the position of the paper delivery roller pair 35 by the feed roller pair 32.

Incidentally, the laser printer 1 according to this embodiment can perform double-sided printing. However, the laser printer 1 is generally set for single-sided printing when the check 3 is used as a recording medium. In setting of single-sided printing, the check 3 carried to the delivery roller pair 35 after the single-sided printing is delivered onto the paper outlet tray 36 by the rotation of the paper delivery roller pair 35.

On the other hand, for example, assume that setting is done for double-sided printing when a sheet of plain paper is used as a recording medium. In such a case, the front and back of the sheet of plain paper fed to the paper delivery roller pair 35 after single-sided printing are reversed due to the reverse rotation of the paper delivery roller pair 35, and fed toward the resist roller pair 12 again along a reverse path 41 and a refeed path 40a following the reverse path 41. In the refeed path 40a, the sheet of paper is carried while being held between a plurality of pairs of refeed rollers 43a and 43b disposed at a distance from one another, and fed to the resist roller pair 12 again through a refeed guide 45. Then, the sheet of paper is subjected to printing on the other unprinted

side thereof by the process unit 18. The sheet of paper after the double-sided printing is delivered onto the paper outlet tray 36 due to the rotation of the paper delivery roller pair 35 as described above.

Incidentally, description has been made above on the case where the check 3 is fed from the paper feed cassette 6a provided in the printer body 1a. However, the check 3 can be selectively fed also from the paper feed cassette 6b, 6c, 6d in the paper feed cassette unit 1b, 1c, 1d shown in Fig. 1, through a paper feed cassette unit feed path 46 (see Fig. 3). Incidentally, a mechanism or control for feeding recording media selectively from paper feed cassette units disposed in a stack are known well. Therefore, their detailed description will be omitted here.

As described above, the laser printer 1 according to the first embodiment has the four paper feed cassettes 6a, 6b, 6c and 6d so that various kinds of prints can be stored in the paper feed cassettes 6a, 6b, 6c and 6d severally. To bring the paper feed cassettes 6b, 6c and 6d into the locked state, only the paper feed cassette 6a having a locking portion is operated so that the other paper feed cassettes 6b, 6c and 6d can be also brought into the locked state concurrently by gang locking. Such a configuration can reduce the cost in comparison with the case where a locking portion is provided for each of the four feed cassettes 6a, 6b, 6c and 6d. In addition, the

locking operation becomes easy for the user because it will go well if locking is performed on only the paper feed cassette 6a having the locking portion without any necessity of performing locking on the paper feed cassettes 6a, 6b, 6c and 6d individually.

When all the paper feed cassettes 6a, 6b, 6c and 6d are brought into the locked state by gang locking, paper feed cassettes used frequently or unnecessary to be protected from theft are also locked. This may be disadvantage for the user. Such disadvantageous can be solved in this embodiment. That is, the locking bars 52a, 52b, 52c and 52d are made removable. A locking bar corresponding to a paper feed cassette unnecessary to be locked is removed, and recording media unnecessary to be protected from theft are stored in the paper feed cassette.

In addition, an apparatus which can solve the disadvantage that a paper feed cassette used frequently or unnecessary to be protected from theft is locked can be realized by a comparatively simple configuration in which the locking bars 52a, 52b, 52c and 52d are made removable thus. In addition, the operation to remove the locking bars 52a, 52b, 52c and 52d is comparatively easy for the user.

In addition, in response to locking, the hook 53d provided in the paper feed cassette 6d closest to the support base 200 projects toward the support base 200, and engages with the printer fixing bar 201 provided in the support base 200. The

laser printer 1 can be fixed to the support base 200 in concurrence with locking by such a comparatively simple configuration. The event that securities are carried away and stolen together with the laser printer 1 can be prevented easily and at a low price.

Although the three paper feed cassette units 1b, 1c and 1d are used in this embodiment, a desired number of paper feed cassette units can be attached to the printer body 1a. Thus, the options of the user can be broadened and the degree of freedom of the laser printer 1 is improved.

When gang locking is performed in response to locking, the printer body 1a and the paper feed cassette units 1b, 1c and 1d removably attached to the printer body 1a are fixed to one other. It is therefore possible to prevent the event that securities are stolen together with each paper feed cassette unit 1b, 1c, 1d removed from the printer body 1a.

More in particular, in response to locking, the lock gears 51a, 51b and 51c rotate so that the hooks 53a, 53b and 53c move toward the paper feed cassette units 1b, 1c and 1d, and engage with the hook destinations 80b, 80c and 80d provided in the paper feed cassette units which are destinations of the hooks 53a, 53b and 53c, respectively. Thus, the printer body 1a and the paper feed cassette units 1b, 1c and 1d disposed in a stack are fixed to one another. Accordingly, a desired number of paper feed cassette units can be installed so that the degree of freedom of the laser printer 1 is improved. In addition,

the event that securities are stolen together with each paper feed cassette unit removed from the printer body 1a can be prevented easily, at a low price and with a comparatively simple configuration.

In addition, the gang lock unit is constituted by a plurality of gears such as lock gears and transmission gears. Due to such a comparatively simple configuration, a laser printer which can lock a plurality of paper feed cassettes with an easy operation can be manufactured easily and at a low price.

Next, a laser printer according to a second embodiment of the invention will be described with reference to Fig. 4. Here, parts similar in structure to those in the laser printer 1 according to the first embodiment are denoted by the same reference numerals correspondingly, and their description will be omitted. Fig. 4 is a front perspective view showing the laser printer according to the second embodiment of the invention, with an explanatory side view of a gang lock unit provided in the laser printer.

This embodiment is different from the first embodiment in the configuration of the gang lock unit. First, as shown in Fig. 4, each hook 153a, 153b, 153c, 153d in this embodiment is received in its corresponding unit in the unhooked state as shown by the broken line in Fig. 4, but it projects downward outside the unit in the hooked state as shown by the solid line.

Hook destinations 180b, 180c and 180d and a printer fixing

bar 202 are disposed in positions corresponding to the tips of the hooks in the locked state. In the first embodiment, each hook destination 80b, 80c, 80d is disposed on the top of the unit body 60b, 60c, 60d while the printer fixing bar 201 is attached to project from the surface of the support base 200. In this embodiment, however, each hook destination 180b, 180c, 180d is disposed inside a unit body 160b, 160c, 160d without projecting from the unit body 160b, 160c, 160d, while the printer fixing bar 202 is disposed inside a hole 200x formed in the surface of the support base 200 as shown in Fig. 5B.

Each transmission gear is received in the printer body or each unit in the first embodiment. In this embodiment, however, each transmission gear projects outside the apparatus. That is, a transmission gear 170a provided in a printer body 101a projects downward from the bottom of the printer body 101a, and lowest transmission gears 170b, 170c and 170d provided in paper feed cassette units 101b, 101c and 101d respectively project downward from the bottoms of the paper feed cassette units 101b, 101c and 101d respectively. Incidentally, in spite of such a structure where the transmission gears project outside the apparatus, the lowest transmission gear 170d is received in a hole 200x formed in the surface of the exclusive support base 200 as shown in Fig. 4 when the paper feed cassette unit 101d is mounted on the exclusive support base 200. Thus, the laser printer 101 can be supported adequately on the support

base 200.

As described above, in the laser printer 101 according to the second embodiment, differently from the laser printer 1 according to the first embodiment, the printer fixing bar 202 does not project from the support base 200. Accordingly, it is possible to avoid such a disadvantage that something is caught by the printer fixing bar 202 after the laser printer 101 has been moved.

However, in this embodiment in which the printer body 101a and the paper feed cassette units 101b, 101c and 101d are stacked vertically and supported on the support base 200, they may be put on a support base which is not the exclusive support base 200 having the hole 200x formed in the surface. In such a case, at the time of locking, there is a fear that the surface of the support base is injured by the tip of the hook 153d provided in the lowest paper feed cassette unit 101d, or the hook 153d is damaged. On the other hand, in the first embodiment, the hook destinations 80b, 80c and 80d are formed on the tops of the unit bodies 60b, 60c and 60d of the paper feed cassette units 1b, 1c and 1d respectively. It is therefore unnecessary to make the tips of the hooks 53a, 53b and 53c project into the unit bodies 60b, 60c and 60d of the adjacent paper feed cassette units 1b, 1c and 1d respectively. Accordingly, even in the locked state, each hook 53a, 53b, 53c is kept in the printer body 1a or the unit body 60b, 60c, 60d of the paper

feed cassette unit 1b, 1c, 1d provided therewith. It is therefore possible to solve the disadvantage that the support base is injured or the hook 153d is damaged.

Although the preferred embodiments of the invention have been described above, the invention is not limited to the embodiments. Various changes in design can be made on the invention without departing from the claimed scope thereof.

For example, although the embodiments have been described on the case where a laser printer is adopted as an example of an image forming apparatus according to the invention, the invention is also applicable to various image forming apparatuses including other printers of an inkjet type and the like, copying machines, facsimile machines, and so on.

In addition, the toner storage portion 26 in the process unit 18 may be filled with regular nonmagnetic toner. Although it is suitable to fill the toner storage portion 26 with mica toner containing magnetic powder when securities such as the checks 3 are used as recording media as in the embodiments, it may be filled with nonmagnetic toner when sheets of plain paper are used as recording media.

Although the unlocked/locked state of each paper feed cassette 6a, 6b, 6c, 6d is selected by use of a mechanical configuration, that is, a plurality of gears in the embodiments, for example, the unlocked/locked state may be selected by an electronic lock (power lock) or the like.

For example, Fig. 6 shows a configuration using a power lock. As shown in Fig. 6, the printer body 1a and the paper feed cassette units 1b, 1c and 1d are provided with power lock portions 1101a, 1101b, 1101c and 1101d. The power lock portions 1101a, 1101b, 1101c and 1101d are connected through a bus 1102 to a controller 1103 that is provided in the printer body 1a. The controller 1103 is configured to control a locked state and an unlocked state of each of the power lock portions 1101a, 1101b, 1101c and 1101d. When the key 90 is inserted into the power lock portion 1101a and the key 90 is rotated in the illustrated arrow direction (clockwise), the power lock portion 1101a brings the paper feed cassette 6a into a locked state. Concurrently, the controller 1103 detects that the power lock portion 1101a to be in a locked state, the controller 1103 controls the power lock portions 1101b, 1101c and 1101d to bring into the locked state in accordance with the locked state of the power lock portion 1101a. In such a manner, the locked state of the power lock portion 1101a is transmitted to the other power lock portions 1101b, 1101c and 1101d. In addition, the controller 1103 may transmit the unlocked state of the power lock portion 1101a to the power lock portions 1101b, 1101c and 1101d. The controller may be operated through the operation portion 15.

Further, the unlocked/locked state of each paper feed cassette 6a, 6b, 6c, 6d is selected by use of alternative

mechanical configuration, such as a link member, or a belt. Fig. 7 shows a configuration in which the unlocked/locked state of each paper feed cassette 6a, 6b, 6c and 6d is selected by use of link members 1201. Fig. 8 shows a configuration in which the unlocked/locked state of each paper feed cassette 6a, 6b, 6c, 6d is selected by use of belts 1301. In these configurations, the lock gears 51a, 51b, 51c and 51d are mechanically connected with each other by the link members 1201 or the belts. Accordingly, rotation of the lock gear 51a is transmitted to the other lock gears 51b, 51c and 51d and gang lock of the paper feed cassette 6a, 6b, 6c and 6d are realized.

The transmission gears may be omitted in the embodiments. In this event, adjacent lock gears are designed to be connected to each other directly. Further, various configurations may be adopted for the gang lock unit if it can perform so-called gang locking in which when at least one of paper feed cassettes with a locking portion is brought into the locked state, the other paper feed cassettes having no locking portion are also brought into the locked state automatically.

Although the embodiments have been described on the case where the paper feed cassette 6a which is one of the four paper feed cassettes and which is provided in the printer body 1a is provided with the key hole 14a and so on as a locking portion, the invention is not limited to such a configuration. For example, the locking portion may be provided not in the printer

body 1a but in one of the paper feed cassette units. Alternatively, a plurality of locking portions may be provided in the paper feed cassette units respectively. The number or assignment of locking portions can be modified variously. However, when the locking portion is provided in the printer body 1a while no locking portion is provided in any paper feed cassette unit as in the embodiments, the paper feed cassette units can be made to have the same configuration as one another. It can be therefore noted that the configuration in the embodiments is advantageous in terms of manufacturing or selling of the paper feed cassette units.

Although the paper feed cassettes are provided in the printer body 1a and the paper feed cassette units 1b, 1c and 1d separate from one another respectively in the embodiments, two or more paper feed cassettes may be provided in the printer body 1a while no paper feed cassette unit is provided. In this case, at least one of the paper feed cassettes provided in the printer body 1a is provided with a locking portion.

In addition, the arrangement of the plurality of paper feed cassettes is not limited to a vertical line as in the embodiments. Paper feed cassettes may be arranged horizontally. Alternatively, a plurality of paper feed cassettes are disposed both vertically and horizontally. The same thing applies not only to the arrangement of a plurality of paper feed cassettes provided in one unit but also to the arrangement of paper feed

cassette units.

Although the locking bar 52a, 52b, 52c, 52d is made removable to avoid gang locking in the embodiments, the invention is not limited to such a configuration. Gang locking may be avoided by various other means. Alternatively, such a unit capable of avoiding gang locking may be not provided.

Although the embodiments have been described on the case where the printer fixing bar 201, 202 provided in the support base 200 for supporting the printer is engaged with a hook provided in a paper feed cassette unit so that the printer can be fixed to the support base concurrently with gang locking of the printer, the invention is not limited to such a configuration. The printer may be fixed to the support base concurrently with gang locking by various other means. Alternatively, such an apparatus fixing unit may be not provided.

When paper feed cassette units separate from the printer body are provided removably, the printer body and the paper feed cassette units are fixed to one another concurrently with gang locking by engagement between hooks and hook destinations in the embodiments. The invention is not limited to such a configuration. The body and the units may be fixed by various other means. Alternatively, such a unit fixing unit may be not provided.

In the embodiments, the hook provided in a paper feed cassette unit having another paper feed cassette unit disposed

thereunder serves to fix the units to each other, while the hook provided in a paper feed cassette having no paper feed cassette unit disposed thereunder and being closest to the support base serves to fix the printer to the support base. That is, each hook has different functions in accordance with its disposition. This is advantageous in terms of reduction in number of parts. However, a unit fixing unit and an apparatus fixing unit may be provided separately. For example, another hook may be provided as an apparatus fixing unit.

While the invention has been described in conjunction with the specific embodiments described above, many equivalent alternatives, modifications and variations may become apparent to those skilled in the art when given this disclosure. Accordingly, the exemplary embodiments of the invention as set forth above are considered to be illustrative and not limiting. Various changes to the described embodiments may be made without departing from the spirit and scope of the invention.